

GROUND WATER PROTECTION IN VIRGINIA

TWENTY-SECOND ANNUAL REPORT OF THE GROUND WATER PROTECTION STEERING COMMITTEE

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WaterSense® Program points to simple ways to save water

<http://www.epa.gov/watersense/water/utilities.htm>

In the United States, our growing population is putting stress on our available water supplies. While the Commonwealth of Virginia is rich in water resources, both in terms of number and diversity, impacts of the recent drought have demonstrated this resource cannot be taken for granted. The Commonwealth and its localities must work together to manage and protect our water resources to meet long term human and environmental needs. Improved coordination of drought response and water resources management activities at the local, regional and state levels are essential to guaranteeing the adequacy of Virginia's water supplies to meeting the current and future needs of Virginia's citizens in an environmentally sound manner.

With at least 36 states anticipating local, regional, or statewide water shortages by 2013, protecting our water has quickly become a national priority. That's why water efficiency has become such an important part of state conservation efforts. Using water more

efficiently helps preserve water supplies for future generations, saves money, and reduces stress on water systems and the environment.

The reasoning for why a water utility, an organization that sells water, would want to encourage people to use less of it, refer to <http://www.epa.gov/watersense/water/utilities.htm>. Both utilities and their customers can benefit substantially when they use water more efficiently.

WaterSense, a partnership program sponsored by the U.S. Environmental Protection Agency (EPA), seeks to protect the future of our nation's water supply by helping consumers identify products in the marketplace that are about 20 percent more efficient, through an easy-to-spot WaterSense label, while ensuring product performance and encouraging innovation in manufacturing.

WaterSense labeled products require no consumer sacrifice—these products have been

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Wellhead protection in the Commonwealth

<http://www.vdh.virginia.gov/drinkingwater/source/swpp.htm>

In July 2003, the Office of Drinking Water (ODW) created a Wellhead Protection Plan (Plan) Development Program for small community groundwater waterworks in central and western Virginia. The goal of the program is to assist waterworks with development and implementation of source water protection plans. The program delivers technical support from a Virginia Department of Health ODW contract provider to small water systems serving less than 3,300 persons. Source Water Protection Programs are voluntary in the Commonwealth of Virginia. However, the resulting protection plans enable participating waterworks to actively safeguard their drinking water sources by managing and controlling activities in the vicinity of the source that could compromise water quality and quantity.

On May 26, 2005, EPA granted final approval to Virginia's Wellhead Protection Program. Protection of ground water source public water systems will be achieved through: ongoing regulatory and non-regulatory state programs; voluntary participation by local governments in land use management; and development of local planning and zoning ordinance that accounts for these issues.

DEQ will serve as the lead agency for coordination of this voluntary

protection program. The Virginia Department of Health will continue as the Commonwealth's regulatory authority for public water supplies, including ongoing oversight of the Drinking Water State Revolving Fund Program. The Wellhead Protection Plan Development Approach

There are several approaches to prepare and implement a Plan. The Virginia Department of Health Wellhead Protection Plan Development Program approach is based on community involvement through establishment of a Local Advisory Committee. Through a series of meetings, this committee works closely with the VDH contractor to identify potential threats to the waterworks' source water and threat control options. Information is gathered into a written Plan that is provided to the waterworks for implementation. The VDH contractor provides guidance and technical support through all phases of Plan development. The following steps in developing a Plan are summarized.

Step 1: Establish a Local Advisory Committee

Community involvement is the KEY to a successful Wellhead Protection Plan. The Local Advisory Committee consisting of waterworks employees, town or local government officials, county or regional government representa-

tives, board members, and/or water customers. They meet several times to develop the Plan. Having extensive knowledge of source water protection, water system components, or waterworks operations is not a prerequisite to being a committee member. For those waterworks participating in the Wellhead Protection Program, the VDH contractor will assist as needed in forming the Local Advisory Committee.

Step 2: Educating the Committee Members

The VDH contractor will meet with the Local Advisory Committee to review source water protection concepts and discuss details of their water system(s). Review and training on these topics assists the Local Advisory Committee members with making informed decisions during the Plan development. The process used to prepare the Plan is also presented so that Local Advisory Committee members know what to expect in future meetings.

Step 3: Source Water Assessment Review

For most waterworks, a Source Water Assessment was completed as part of the state Source Water Assessment Program. This assessment acts as an initial inventory of potential sources of contamination and provides a general assessment

Wellhead protection ■ CONTINUED

of water supply susceptibility. The Local Advisory Committee reviews the findings of the Source Water Assessment. The Assessment may require an update of potential sources of contamination. The goal of this step is to identify priority issues and challenges for developing and implementing the Plan.

Step 4: Identification of Wellhead Protection Options

There are numerous protective measures that might be implemented; these include public education, planning and policy approaches, regulatory approaches, and non-regulatory approaches. The Local Advisory Committee discusses options that are applicable to their waterworks and then selects the wellhead protection measures that best protect their source water. The VDH contractor assists participants in the Wellhead Protection Program by providing technical expertise, reference materials, and consulting. A list of some possible protective measures is listed.

Step 5: Wellhead Protection Plan Development

Information from the waterworks is used in conjunction with; the Source Water Assessment, other identified potential threats, and the control options selected by the Local Advisory Committee to prepare the Plan. Plan components

Wellhead Protection Measures

1. Public Education
 - Work with community groups
 - Place signs along roads that state “Entering a Source Water Protection Area”
 - Display material on town or water system web site.
 - Distribute brochures to water customers and residents in the Wellhead Protection Area
2. Planning and Policy
 - Compliance Planning
 - Memo of Inter-jurisdictional Cooperation
 - Capital Improvement Program
 - Emergency Response Plan
3. Regulatory
 - Zoning: Wellhead Protection Overlay District
 - Review procedure for subdivisions specifically for Wellhead Protection
 - Septic system ordinances
 - Sinkhole ordinances
4. Non-regulatory
 - Acquisition of property of easements
 - Use of Value Taxation

typically include the following: description of the water system, identification of potential sources of contamination (PSC), process to manage/minimize current risks, and a method to minimize future threats.

The VDH contractor will assist small community groundwater waterworks that participate in the Wellhead Protection Program in developing the Plan and will provide copies of the Plan for use

and implementation by the waterworks, local agencies and other interested parties.

Step 6: Plan Implementation

Once finalized the Plan, including the selected protection options are implemented by the waterworks and/or the local government. Implementation often includes notifying the users and nearby

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Opportunities to fund wellhead protection activities


<http://www.deq.virginia.gov/gwpssc/whp.html>

Following Federal approval of the State's Voluntary Wellhead Protection Plan, DEQ and VDH worked together to issue a "Request for Proposals" from local governments to implement wellhead protection. A combination of SDWA set aside funds and Clean Water Act funds were used to fund the projects. Three awards were made in 2005 totaling \$31,250. A second "Request for Proposals" from local governments to implement well-

head protection was issued July 2006. Four awards were made totaling \$147,390. A third "Request for Proposals" was issued in July 2007. Six proposals were received with three awards made totaling \$182,858. The fourth "Request for Proposals" in July 2008 resulted in three awards totaling \$145,715. Interest in the grants continues to increase. As long as VDH and DEQ are able to earmark a portion of their federal dollars toward implementation

these "Request for Proposals" will continue. Our goal is to issue the request annually in June or July to enable contracts to be in place by October 1. Municipalities with ground water based community water supplies are encouraged to submit a proposal to implement local wellhead protection activities. For information on the solicitation of proposals contact Mary Ann Massie at mamassie@deq.virginia.gov or visit <http://www.deq.virginia.gov/gwpssc/whp.html>.

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Wellhead Protection

Wellhead protection activities continue to increase in the Commonwealth. While there has not been a stampede to graduate **from assessing** a public water supply's contamination susceptibility **to implementing** measurable protection activities, there continues to be interest at the local level in developing strategies to protect ground water resources. These local efforts are often buoyed by technical support from Virginia Department of Health (VDH) field office staff, the VDH contract with Oliver Inc. to assist small systems in priority areas, or grants issued directly to municipalities through the Virginia Department of Environmental Quality in conjunction with VDH.

The 1996 amendments to the Safe Drinking Water Act (SDWA) expanded protection concepts from ground water based public water supply systems to all sources of water serving public water supply systems, including surface water. The 1996 amendments also required assessments to evaluate every public water supply system's vulnerability or susceptibility to contamination. These mandatory assessments were supported with dedicated funding from the Drinking Water State Revolving Loan (DWSRF) set asides; assessments were completed by the Virginia Department of Health (VDH). Information gained through the assessments was shared with system owners and consumers. Federal and State officials were hopeful these assessments and susceptibility determinations would be the foundation for protection programs.

Opportunities to fund wellhead protection activities:
Following Federal approval of the State's Voluntary Wellhead Protection Plan, DEQ and VDH worked together to issue a "Request for Proposals" from local governments to implement wellhead protection. A combination of SDWA set aside funds and Clean Water Act funds were used to fund the projects. Three awards were made in 2005 totaling \$31,250. A second "Request for Proposals" from local governments to implement wellhead protection was issued July 2006. Four awards were made totaling \$147,390. A third "Request for Proposals" was issued in July 2007. Six proposals were received with three awards made totaling \$182,858. The fourth "Request for Proposals" in July 2008 resulted in three awards totaling \$145,715. Interest in the grants continues to increase. As long as VDH and DEQ are able to earmark a portion of their federal dollars toward implementation these "Request for Proposals" will continue. Our goal is to issue the request annually in June or July to enable contracts to be in place by October 1.

- [Wellhead Protection Plan, 2005](#)
- [Report of the Ad Hoc Wellhead Protection Advisory Committee, 1991](#)
- [Wellhead Protection: A Handbook for Local Governments in Virginia, 1991](#)
- [Wellhead Protection: Case Studies of Six Local Governments in Virginia, 1993](#)
- [Implementing Wellhead Protection: Model Components for Local Governments in Virginia, 1998](#)



Wellhead Protection

Funding Opportunities for Wellhead Protection

2008 Awards
The Town of Burkeville, the Town of Lovettsville, and the Augusta County Service Authority successfully competed to receive funding under an RFP issued specifically for wellhead protection projects. The Virginia Department of Health and the Virginia Department of Environmental Quality cooperated on the issuance of the RFP and in developing the funding sources for future projects. The Town of Burkeville received \$1,517 to implement protection measures identified in their wellhead protection plan (completed by VDH contractor Oliver Inc.) which includes erecting signs, creating a brochure, and providing spill containment equipment for emergency responders; the Town of Lovettsville received \$64,987 to draft and present revisions to their comprehensive plan and zoning ordinances for further implementation of their protection plan; Augusta County Service Authority received \$78,750 to identify the recharge area for the Hurd-Hershey-Ridgeview wells which will complete delineations for the South River system.

2008-2010 proposed budget reductions for water programs

<http://www.dhcd.virginia.gov>

Like many state programs and services that are seeing proposed funding reductions, proposed amendments to the 2008-2010 state budget will reduce general fund appropriations for drinking water and other water-related programs administered by the Virginia Department of Housing and Community Development (DHCD). These amendments must be considered by the 2009 Virginia General Assembly and signed into law by the Governor before taking effect.

One amendment reduces funding for the Indoor Plumbing Rehabilitation Grant Program by \$1.6 million in state FY 2009 and FY 2010. The program provides for the rehabilitation of homes lacking indoor plumbing. Indoor plumbing rehabilitation efforts will continue throughout the state. The reductions leave a remaining balance of \$2.88 million from state general funds, and an estimated \$4.5 million in each year from federal grant funds to continue to provide services.

Another amendment would reduce general fund appropriations by \$200,469 in FY 2010 for the Southeast Rural Community Assistance Project, or SERCAP. SERCAP provides assistance to low-income individuals for water and sewer connections.

The third amendment impacting DHCD water-related programs would reduce funding for Southwest Virginia Water Construction Grants by \$225,000 for FY 2010. SVWCG provides funding for public water projects in Southwest Virginia. These cutbacks will reduce the scope of projects and the number of households being served. However, approximately \$2.1 million will remain in the program to provide services. An additional amendment reduces general fund appropriations by \$56,250 in FY 2010 for Southwest Virginia Water Planning Grants. These grants provide funding for water and sewer projects to the LENOWISCO, Cumberland Plateau and Mount Rogers Planning District Commissions (PDC). Each of the three PDCs will have its funding reduced by \$18,750.

Article submitted by Wyatt Little, wyatt.little@dhcd.virginia.gov.

The Ground Water Protection Steering Committee Overview:

The Ground Water Protection Steering Committee is an inter-agency advisory committee formed to stimulate, strengthen and coordinate ground water protection activities in the Commonwealth. The Annual Reports allow us to highlight our progress; to educate Virginia citizens, businesses, and officials about the importance of ground water; and to publicize state programs that can assist those relying on ground water to ensure its continued quality and availability.

Particular emphasis is made at the meetings on education and information exchange. Meetings are open to the public. In 2008 our members and guests heard presentations on activities in DEQ's Office of Land Application, DEQ's Surface Water Investigations Program, Virginia Tech's Master Well Owner Network (MWON) and Household Water Quality Program (HWQP), wellhead protection programs in the Commonwealth, and DEQ's Office of Voluntary Remediation.

For more information on the Steering Committee visit <http://www.deq.virginia.gov/gwpsc> or call Mary Ann Massie at 804-698-4042.

Waste program update

<http://www.deq.virginia.gov/waste/homepage.html>

The organizational objective of the DEQ's Office of Hazardous Waste's ground water section is to protect Virginia's environment and citizens' health through the evaluation and the issuance of hazardous waste permits and permit amendments, and the review of environmental plans and data. Staff review and evaluate hazardous waste ground water monitoring plans, corrective action plans, permit applications and amendments, and environmental monitoring data. Team Leader Jutta Schneider can be reached at (804) 698-4099 or jschneider@deq.virginia.gov.

DEQ continues to work cooperatively with EPA Region 3 to address clean-up at 121 sites statewide where the agencies plan to have largely completed clean-up activities by the year 2020. These sites, referred to as the "2020 Corrective Action Universe," include all facilities believed to need corrective action in Virginia, as well as those with already ongoing or completed cleanups.

As of September 30, 2008, Virginia has determined that migration of contaminated ground water is under control for 47 out of 59 sites currently active in the RCRA corrective action process. Two of these sites were designated during the federal fiscal year ending on September 30th, with one site demonstrating that there has been no impact to ground water and one

site demonstrating that remediation measures have resulted in a stable and/or shrinking ground water contamination plume. In addition to the 12 remaining sites currently in corrective action, ground water impacts at an additional 62 sites will need to be assessed and potentially remediated by 2020. For more information, please visit <http://www.epa.gov/reg3wcmd/ca/va.htm>.

The organizational objective of the DEQ's Office of Solid Waste is the protection of Virginia's air, water, and land and to ensure a healthy environment by promoting, guiding, and regulating the effective management of solid waste through the development of environmental control permits for solid waste management facilities in accordance with applicable laws and regulations. The DEQ's solid waste ground water program achieved full staffing in 2008 with each of the 6 regional offices having at least one GW staffer. In mid 2008, the Department began work on revising and modernizing some portions of the existing solid waste ground water regulations, but none of the proposed changes will substantially modify the existing requirements concerning corrective action. The proposed regulations will likely be presented for public comment in 2009. The Solid Waste Ground Water Program Coordinator in the Central Office is Geoff Christe, who can be reached at gxchriste@deq.virginia.gov or at (804) 698-4283.

The Ground Water Protection Steering Committee Meetings:

The Ground Water Protection Steering Committee meeting is held on the third Tuesday of March, May, July, September and November.

Meetings are generally held at the Department of Environmental Quality, 629 East Main Street, Richmond, from 9 a.m. to 11 a.m.

Meetings are open to the public.

For more information, contact Mary Ann Massie at DEQ, 804-698-4042 or email mamassie@deq.virginia.gov or visit <http://www.deq.virginia.gov/gwpsc>.



Meeting summaries and announcements are posted on the Regulatory Townhall at <http://www.townhall.virginia.gov>.



Pesticide disposal program

<http://www.vdacs.virginia.gov/pesticides/index.shtml>

The Virginia Department of Agriculture and Consumer Services (VDACS), in cooperation with the Virginia Pesticide Control Board and Virginia Cooperative Extension (VCE) completed the 2008 Pesticide Disposal Program in mid September. The disposal of canceled, banned or unwanted agricultural and commercial pesticides poses a significant challenge to agricultural producers and other pesticide users due to its high cost. The proper disposal of waste pesticides eliminates a potential threat to health and the environment.

In 2008, a total of 32,036 pounds of unwanted pesticides were collected at no cost to participants, including 10,003 pounds of liquid pesticides, 7,059 pounds of solid pesticides, 14,297 pounds of bulk liquid pesticides, 177 pounds of homeowner pesticides and 500 pounds of pesticides from golf courses. Since its inception, Virginia's Pesticide Disposal Program has collected and destroyed 1,439,451 pounds of outdated and unwanted pesticides. This year marked the final year of the Program's first five year rotation throughout the State. In those five years, the disposal covered every area of the state. VDACS will begin the second five-year rotation in 2009 in the following localities: the counties of Accomack, Charles City, Chesterfield, Dinwiddie, Franklin, Goochland,



Pictured are canceled, banned or unwanted agricultural and commercial pesticides. Photograph taken by Charles A. Magolda, pesticide investigator—Roanoke Territory, at a collection site.

Greensville, Hanover, Henrico, Isle of Wight, James City, Poquoson, New Kent, Northampton, Prince George, Powhatan, Southampton, Surry, Sussex and York, and the cities of Chesapeake, Colonial Heights, Emporia, Hampton, Hopewell, Newport News, Norfolk, Petersburg, Portsmouth, Richmond, Suffolk, Virginia Beach and Williamsburg.

For additional information visit the Virginia Department of Agriculture and Consumer Services website at <http://www.vdacs.virginia.gov/pesticides/disposal.shtml> or contact Liza Fleeson, Program Manager, Office of Pesticide Services, at liza.fleeson@vdacs.virginia.gov or 804-371-6559. Interested participants may also contact their local Virginia Cooperative Extension Agent for details.

Plastic pesticide container recycling program

<http://www.vdacs.virginia.gov/pesticides/recycling.shtml>

The Virginia Department of Agriculture and Consumer Services (VDACS), in cooperation with the Virginia Pesticide Control Board, Virginia Cooperative Extension (VCE) and local governments collected and granulated a total of 76,957 containers or 126,355 total pounds of properly-rinsed plastic pesticide containers at 29 sites (21 localities and eight licensed dealers) during 2008. Since its inception, this program has collected and granulated a total of 930,687 containers which equates to over one million pounds of plastic collected for refabrication. The 2008 participating localities included the counties of Brunswick, Clarke, Dinwiddie, Floyd, Frederick, Greensville, Isle of Wight, Madison, Mecklenburg, New Kent, Northampton, Orange, Prince George, Pulaski, Rockingham, Southampton and Sussex and the cities of Chesapeake and Virginia Beach.

The pesticide container recycling program is an environmentally-responsible alternative for the disposal of properly-rinsed plastic pesticide containers. Granulated chips are transported to recycling facilities and fabricated into items such as pallets, fence posts, field drain tiles and parking stops, keeping the containers out of landfills. To participate in the Plastic Pesticide Container Recycling Program, a locality must apply to VDACS and agree to collect, inspect and



Pictured are plastic pesticide containers at one of 29 sites in Virginia. Photograph taken by Robert C. Christian, pesticide investigator—Franklin Territory, at a collection site.

store the properly-rinsed containers until granulation. VDACS provides up to \$1,875 in reimbursement costs to each participating locality to offset the cost of the program.

For additional information visit the Virginia Department of Agriculture and Consumer Services web site at <http://www.vdacs.virginia.gov/pesticides/recycling.shtml> or contact Liza Fleeson, Program

Manager, Office of Pesticide Services, at liza.fleeson@vdacs.virginia.gov or 804-371-6559.

U.S. Geological Survey

<http://va.water.usgs.gov/>

A large scale effort by the U.S. Geological Survey (USGS) for region-wide characterization of ground water throughout the Virginia Coastal Plain continued during 2008, in cooperation with the Virginia Department of Environmental Quality (DEQ) and the Hampton Roads Planning District Commission (HRPDC) (see 2000-08 Annual Reports). Southeastern Virginia, the York-James Peninsula, and the Virginia Eastern Shore have been designated by the Commonwealth of Virginia as ground-water management areas, and ground-water withdrawals on the Middle Peninsula and Northern Neck also are increasing. The Eastern Shore is further distinguished as a sole source aquifer.

A report was published during 2008 on private domestic wells and withdrawals in the Virginia Coastal Plain (USGS Scientific Investigations Report 5250, available at <http://pubs.usgs.gov/sir/2007/5250/>). Included are a summary of well characteristics, an assessment of the aquifers being tapped, and an estimate of withdrawal distribution based on population and road-density information. Also during 2008, printing and distribution was completed of a report on a refined hydrogeologic framework of Virginia Coastal Plain (published on-line during 2007 as USGS Professional Paper



Figure 1 Ground-water research station constructed near Sebrell in Southampton County during May-June 2008. Data from down-hole water-level transducers installed in each observation well are automatically recorded at the centrally located logger, and transmitted continuously via satellite to the USGS on-line data base, available at http://waterdata.usgs.gov/va/nwis/current/?type=gw&group_key=county_cd

1731, available at <http://pubs.usgs.gov/pp/2006/1731/>). Publication during 2009 is planned for reports of two new computer models of ground-water flow,

including one model of the entire Virginia Coastal Plain that was developed in cooperation with HRPDC and DEQ, and another model of the Virginia Eastern

U.S. Geological Survey ■ CONTINUED

Shore that was developed in cooperation with the Accomack-Northampton PDC and DEQ. The framework and models will be used by local communities for long-term water supply planning, and by DEQ to support ground-water permitting decisions.

One result of framework and model analyses is identification of areas needing improved data. Among these, some model simulations indicated water-level drawdowns in north-central Southampton County approaching the tops of aquifers, but actual conditions were not observed closely enough to adequately evaluate these model results. Accordingly, a 602-foot exploratory borehole and geophysical log, a 537-foot sediment core, and four observation wells were drilled in cooperation with DEQ and HRPDC during May-June 2008, to establish a ground-water research station near Sebrell (figure 1). The stratigraphic sequence exhibited by the core reveals new relations among the hydrogeologic units, and ground-water levels in the newly constructed wells are being continuously monitored as part of the statewide observation-well network. These data are being analyzed to determine the true relation of drawdowns to the aquifers. Chemical-quality samples were also collected from the completed wells as part of the ground-water chloride monitoring network, maintained in cooperation with HRPDC.

A study of ground water quality in the Virginia Coastal Plain also continued during 2008, in cooperation with DEQ and HRPDC. Interpretive analysis was completed of ground-water quality data on approximately 10,000 samples retrieved during 2006 from USGS, DEQ, U.S. Environmental Protection Agency (EPA), and Virginia Department of Health (VDH) data bases. Publication of the study results is planned for 2009, to include spatial characterization of major ions and secondary constituents, and delineation of the freshwater-saltwater transition zone.

Study of the shallow aquifer system in Virginia Beach also continued during 2008, in cooperation with the City of Virginia Beach. Shallow ground water is the primary domestic source of water in the southern part of the City, and is also withdrawn by residents toward the north for irrigation and seasonal needs. Ground-water levels, however, are below sea level in many areas and create the potential for saltwater intrusion. The purpose of the study is to better understand the structure of the shallow aquifers and aspects concerning saltwater intrusion and to aid the City in making sound water-resource management decisions.

Hydrostratigraphic relations across Virginia Beach are complex. Accordingly, an intense

observation-well drilling program was undertaken in the northern part of the City during June-July 2008, to expand a network of observation wells earlier established toward the south. Continuous sediment cores and geophysical logs were generated while drilling 14 new wells, from which chemical-quality samples were then collected for laboratory analysis of chloride and other major ions.

Two of the wells were added to a network of approximately 40 wells that monitors real-time water levels and other ground-water information across the City. Other network wells also were used during 2008 to collect 10 chemical-quality samples, and to generate 6 geophysical logs. Maintenance of the monitoring network is planned for 2009, along with further sampling and logging. In addition, publication of a fact sheet is planned to present results of an earlier completed survey of ground-water use in the City. Project results can be viewed online at <http://va.water.usgs.gov/projects/va113.html>.

A new study to monitor potential movement of the saltwater transition zone beneath Virginia's Eastern Shore was initiated during 2008. Because of the lack of fresh surface water on the Eastern Shore, nearly all freshwater is supplied by a shallow and laterally constrained aquifer system. Expanding well withdrawals continually increase the likelihood of saltwater intrusion from nearby Chesapeake Bay to the west and the Atlantic Ocean to the

U.S. Geological Survey ■ CONTINUED

east. Possible future increases in ground-water salinity on both sides of the peninsula have been indicated by the computer model developed by USGS (see above).

To monitor possible future movement of the saltwater transition zone on the Eastern Shore, a program was begun during 2008 of electromagnetic (EM) induction logging of wells. Differences over time among EM-induction logs can provide a cost-effective means of monitoring transition-zone movement, where ground-water chemistry is dominated by the contrast between freshwater and saltwater. A preliminary network of existing wells was established, based on model simulations of future transition-zone movement, and on observed magnitudes and temporal trends in chloride-sample concentrations. From among the network, 12 wells were logged during June-July 2008. Logging additional wells in subsequent years will depend on the final size of the network. Once the entire network is completed, the logging schedule will be repeated to determine any changes resulting from movement of the saltwater transition zone.

Lastly, in another new study in cooperation with the Chesapeake Bay Program, a series of computer models are being constructed of shallow ground-water flow in the Chesapeake Bay watershed, to help explain the role of ground water in the transport of nitrogen to the

Bay. A model of the Delmarva Peninsula was developed during 2008, from which simulations are now being performed, and a second model of the Bay's western shore in Maryland, Virginia, and Pennsylvania is under construction. Additional models are planned for other parts of the watershed.

The USGS continued the cooperatively funded assessments on the availability of ground water in the northern Shenandoah Valley carbonate and fractured-rock aquifer systems with Frederick, Warren, and Clarke counties, and continued the South Fork Shenandoah River Minimum Instream Flow (MIF) investigation in cooperation with the Northern Shenandoah Valley Regional Commission and the Central Shenandoah Planning District Commission.

Results from construction and calibration of a regional ground-water-flow model of the Shenandoah Valley were documented in "Yager, R.M., Southworth, C. Scott, and Voss, C.I., 2008, Simulation of ground-water flow in the Shenandoah Valley, Virginia and West Virginia, using variable-direction anisotropy in hydraulic conductivity to represent bedrock structure: U.S. Geological Survey Scientific Investigations Report 2008-5002," which is currently in press and provides information to better define the availability of ground water in the region and its response to current and future development.

The model represents a 7,500-km² area that contains three hydrogeologic units that correspond to the major rock types in the Shenandoah Valley (siliciclastic rocks, carbonate rocks, and crystalline rocks). Ground-water flow was simulated using variable-direction anisotropy in hydraulic conductivity in the inclined, fractured sedimentary rocks. The anisotropy is a consequence of the orientations of bedding planes and fractures that provide preferential flow paths through the rock, such that the direction of maximum hydraulic conductivity is oriented within the bedding plane, and the direction of minimum hydraulic conductivity is perpendicular to the bedding. The dominant foliation in the sedimentary rocks is bedding, which mostly strikes N30oE.

Additional gravity measurements were completed in the Shenandoah Valley to gain insight into the porosity of the underlying fractured-bedrock aquifers in the region and their ground-water capacity, and the USGS began monthly measurements of discharge and the concentrations of a suite of environmental tracers in discharge from some 5 springs in the northern Shenandoah Valley. The measurements include (among other chemical and isotopic parameters) carbon-14, chlorofluorocarbons, sulfur hexafluoride, tritium, tritium/helium-3, and two new environmental

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WaterSense® Program ■ CONTINUED FROM PAGE 1

independently certified to use less water while performing as well as or better than conventional models. WaterSense is also labeling certification programs for irrigation professionals, helping to encourage water efficiency in the landscaping business.

But EPA can't do this alone. WaterSense is partnering with water utilities, government agencies, and other promotional partners, as well as manufacturers, retailers, distributors, certifying organizations, and irrigation professionals who have completed a WaterSense labeled program, to help make water-efficient products and practices commonplace.

In addition to benefiting the environment, WaterSense partners can reap benefits from the program. As a WaterSense partner, your organization will:

- Receive recognition from EPA as an environmental steward.
- Be identified as a leader in water efficiency by using the WaterSense partner logo.
- Increase exposure by being listed as a WaterSense partner on the program Web site.
- Strengthen your water efficiency outreach efforts with a credible, national brand and a strong, consistent message.
- Reduce market research costs and increase confidence in promoting water-efficient products that meet or exceed WaterSense criteria.
- Access and customize free tools and resources to leverage the WaterSense brand and to promote water efficiency to your customers.

If you would like to learn more WaterSense and how to become a partner, visit the WaterSense Web site at <http://www.epa.gov/watersense> or call the WaterSense Helpline at (866) WTR-SENS (866-987-7367).

Visit DEQ's Water Supply Planning web page to learn more about WaterSense! <http://www.deq.virginia.gov/watersupplyplanning/WaterSense.html>

The following agencies have representation on the Ground Water Protection Steering Committee:

- Virginia Department of Environmental Quality (chair)
- Virginia Department of Health
- Virginia Cooperative Extension
- Virginia Department of Business Assistance
- Virginia Department of Conservation and Recreation
- Virginia Department of Mines, Minerals, and Energy
- Virginia Department of Agriculture and Consumer Services
- Virginia Department of Housing and Community Development
- Virginia Department of General Services/Division of Consolidated Laboratory Services
- US Geological Survey

Visit

<http://www.deq.virginia.gov/gwpsc> for member links.

Wellhead protection

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residents of the wellhead protection measures that are in-place or are planned. VDH-ODW offers funding opportunities to assist public water systems to implement their Plan. The funding application packages for the new funding cycle will be sent out in early 2009. Results of the Program

To date this program has enabled over a hundred small water systems to prepare and implement site-specific Wellhead Protection Plans. Participation in this program has enabled several small water systems to prepare and implement site-specific Wellhead Protection Plans while a number of other waterworks are currently in the process of completing Wellhead Protection Plans. Other program activities included contacting waterworks to determine interest, making program presentations, and holding Local Advisory Committee meetings to facilitate implementing the program.

For more information on protection program activities through the VDH-ODW contract email Barry Matthews, VDH-ODW, Barry.Matthews@vdh.virginia.gov.

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tracers that the USGS recently developed for ground-water dating—SF5CF3 and CFC-13. These new data will allow us to learn more about the transient nature of age distribution in spring discharge in the Valley. The age information will help constrain ground-water models as they are developed.

The USGS and DEQ Ground-Water Characterization Program continued the maintenance and expansion of the real-time ground-water data network for Virginia. In addition to the four new wells in Southampton County, three 6-inch diameter observation wells were completed via air-rotary drilling at Montvale Park, Montvale School, and the Otter Creek Solid Waste Collection center in Bedford County and instrumented for real-time data transmission. Finally, an individual well was instrumented for real-time data transmission and added to the data network in each of Bath, Brunswick, Buchanan, Nottoway, Shenandoah, and Wise counties, respectively.

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